

**DATA SHEET**  
**SE2576L: 2.4 GHz High Power Wireless LAN Power Amplifier**  
**Preliminary**

### Applications

- IEEE802.11b DSSS WLAN
- IEEE802.11g,n OFDM WLAN
- Access Points

### Features

- Dual Mode IEEE802.11b, IEEE802.11g, IEEE802.11n
- 26 dBm, EVM = 3%, 802.11g, OFDM 54 Mbps
- 29 dBm, 802.11b mask compliant
- Integrated PA, Input Match, 2.8V reference voltage generator
- Integrated Temperature Compensated, Positive Slope Power Detector
- Pb-free, RoHS compliant and Halogen-free
- 3 mm x 3 mm x 0.9 mm, MSL 3

### Product Description

The SE2576L is a high power 802.11bgn WLAN power amplifier module providing the functionality of the power amplifier, power detector, reference voltage generator and input match.

The SE2576L is designed for ease of use and maximum flexibility, with an integrated input match, and external output match to adjust the load line for 5V, 26dBm operation.

The SE2576L includes a temperature compensated transmit power detector with over 20 dB of dynamic range and <1.2dB variation under 3:1 mismatch at the antenna.

The SE2576L includes a digital enable control due to an integrated reference voltage generator. The power ramp rise/fall time is 0.5  $\mu$ s typical.

### Ordering Information

| Part No.    | Package    | Remark         |
|-------------|------------|----------------|
| SE2576L     | 16 pin QFN | Samples        |
| SE2576L-R   | 16 pin QFN | Tape & Reel    |
| SE2576L-EK1 | N/A        | Evaluation kit |

### Functional Block Diagram

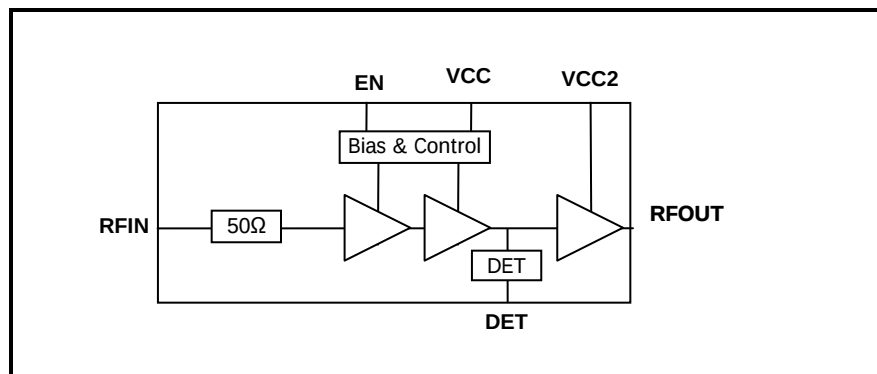


Figure 1: Functional Block Diagram

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**Pin Out Diagram**

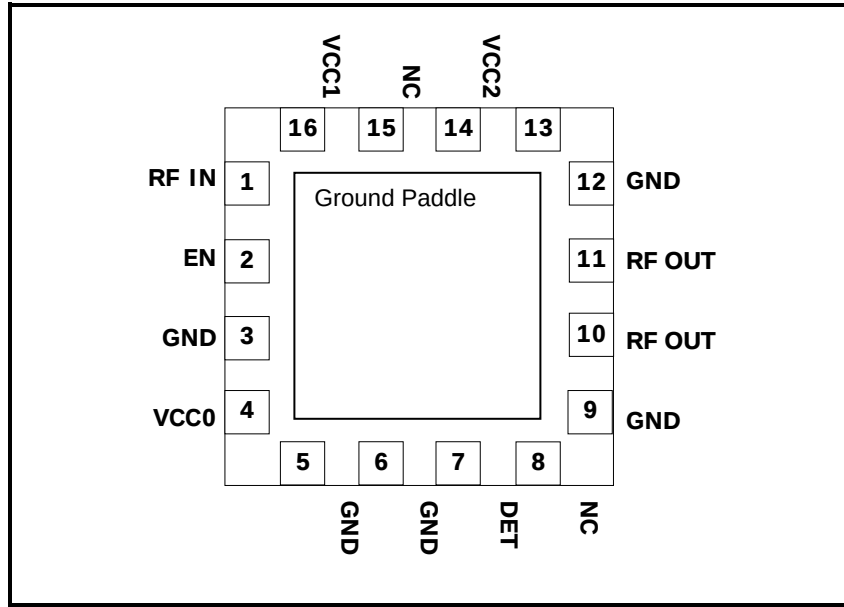


Figure 2: SE2576L Pin Out (Top View Through Package)

**Pin Out Description**

| Pin No.    | Name   | Description                                   |
|------------|--------|-----------------------------------------------|
| 1          | RF IN  | RF Input                                      |
| 2          | EN     | Power Amplifier Enable                        |
| 3          | GND    | Ground                                        |
| 4          | VCC0   | Power Supply for Bias Circuit                 |
| 5          | GND    | Ground                                        |
| 6          | GND    | Ground                                        |
| 7          | DET    | Power Detector Output                         |
| 8          | NC     | No Connect. May be left floating or grounded. |
| 9          | GND    | Ground                                        |
| 10         | RF OUT | RF Output                                     |
| 11         | RF OUT | RF Output                                     |
| 12         | GND    | Ground                                        |
| 13         | VCC2   | Power Supply for 2 <sup>nd</sup> Stage        |
| 14         | NC     | No Connect. May be left floating or grounded. |
| 15         | VCC1   | Power Supply driver stages                    |
| 16         | GND    | Ground                                        |
| Die paddle | GND    | Ground                                        |

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### Absolute Maximum Ratings

These are stress ratings only. Exposure to stresses beyond these maximum ratings may cause permanent damage to, or affect the reliability of the device. Avoid operating the device outside the recommended operating conditions defined below. This device is ESD sensitive. Handling and assembly of this device should be at ESD protected workstations.

| Symbol             | Definition                               | Min. | Max. | Unit |
|--------------------|------------------------------------------|------|------|------|
| VCC0, 1, 2         | Supply Voltage on VCC                    | -0.3 | 5.5  | V    |
| V <sub>IN</sub>    | DC input on EN                           | -0.3 | 3.6  | V    |
| TX                 | RF Input Power. RF Out terminated in 50Ω | -    | 12.0 | dBm  |
| T <sub>A</sub>     | Operating Temperature Range              | -40  | 85   | °C   |
| T <sub>STG</sub>   | Storage Temperature Range                | -40  | 150  | °C   |
| ESD <sub>HBM</sub> | JEDEC JESD22-A114<br>all pins            | -    | 1000 | V    |

### Recommended Operating Conditions

| Symbol         | Parameter                             | Min. | Typ. | Max. | Unit |
|----------------|---------------------------------------|------|------|------|------|
| T <sub>A</sub> | Ambient temperature                   | -40  | 25   | 85   | °C   |
| VCC            | Supply voltage, relative to GND = 0 V | 4.5  | 5    | 5.5  | V    |

### DC Electrical Characteristics

Conditions: VCC = 5 V, EN = V<sub>ENH</sub>, T<sub>A</sub> = 25 °C, as measured on Skyworks Solutions' SE2576L-EV1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted

| Symbol              | Parameter            | Conditions                                               | Min. | Typ. | Max. | Unit |
|---------------------|----------------------|----------------------------------------------------------|------|------|------|------|
| I <sub>CC-G</sub>   | Total Supply Current | P <sub>OUT</sub> = 26 dBm, 54 Mbps OFDM signal, 64QAM    | -    | 500  | -    | mA   |
| I <sub>CC-B</sub>   | Total Supply Current | P <sub>OUT</sub> = 29 dBm, 11 Mbps CCK signal, BT = 0.45 | -    | 650  | -    | mA   |
| I <sub>CC-OFF</sub> | Total Supply Current | EN = 0 V, No RF Applied                                  | -    | 10   | 100  | μA   |

### Logic Characteristics

Conditions: VCC = 5 V, EN = V<sub>ENH</sub>, T<sub>A</sub> = 25 °C, as measured on Skyworks Solutions' SE2576L-EV1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

| Symbol           | Parameter                        | Conditions | Min. | Typ. | Max. | Unit |
|------------------|----------------------------------|------------|------|------|------|------|
| V <sub>ENH</sub> | Logic High Voltage (Module On)   | -          | 1.8  | -    | 3.6  | V    |
| V <sub>ENL</sub> | Logic Low Voltage (Module Off)   | -          | 0    | -    | 0.4  | V    |
| I <sub>ENH</sub> | Input Current Logic High Voltage | -          | -    | 300  | -    | μA   |

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| Symbol           | Parameter                       | Conditions             | Min. | Typ. | Max. | Unit |
|------------------|---------------------------------|------------------------|------|------|------|------|
| I <sub>ENL</sub> | Input Current Logic Low Voltage | V <sub>EN</sub> = 0.4V | -    | 1    | 50   | μA   |
| Z <sub>EN</sub>  | Enable pin input impedance      | Passive Pull Down      |      | 10   |      | kΩ   |

**AC Electrical Characteristics**

**802.11g/n Transmit Characteristics**

Conditions: VCC = 5 V, EN = 3.3 V, T<sub>A</sub> = 25 °C, as measured on Skyworks Solutions' SE2576L-EV1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

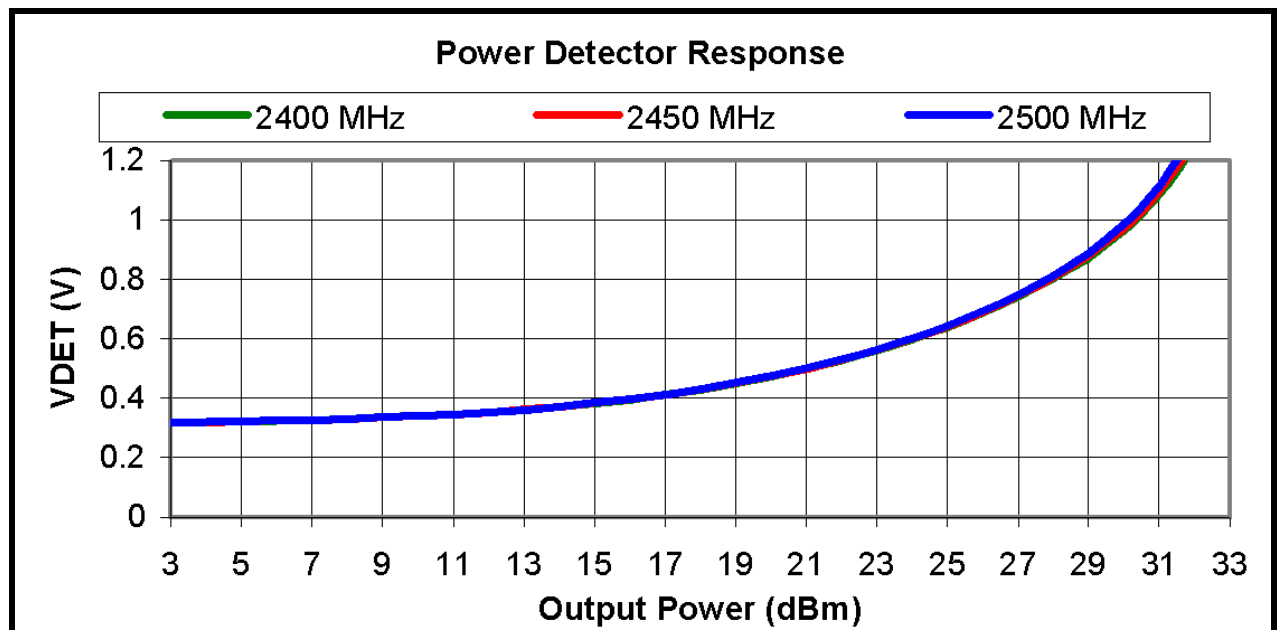
| Symbol                            | Parameter                   | Condition                                                            | Min.                                                       | Typ. | Max. | Unit    |
|-----------------------------------|-----------------------------|----------------------------------------------------------------------|------------------------------------------------------------|------|------|---------|
| F <sub>IN</sub>                   | Frequency Range             | -                                                                    | 2400                                                       | -    | 2500 | MHz     |
| P <sub>OUT</sub>                  | Output Power                | 54 Mbps OFDM signal, 64 QAM, 3% EVM                                  | -                                                          | 26   | -    | dBm     |
|                                   |                             | 1 Mbps CCK signal, BT = 0.045, Mask                                  |                                                            | 29   |      |         |
|                                   |                             | 802.11n, HT20, all data rates, Mask                                  |                                                            | 30   |      |         |
|                                   |                             | 802.11n, HT40, all data rates, Mask                                  |                                                            | 27   |      |         |
| P <sub>1dB</sub>                  | P1dB                        | -                                                                    | -                                                          | 32   | -    | dBm     |
| S <sub>21</sub>                   | Small Signal Gain           | -                                                                    | 30                                                         | 33   | -    | dB      |
| ΔS <sub>21</sub>                  | Small Signal Gain Variation | Gain variation over single 40MHz channel                             | -                                                          | 0.5  | -    | dB      |
|                                   |                             | Gain Variation over band                                             | -                                                          | 1.0  | -    |         |
| 2f                                | Harmonics                   | P <sub>OUT</sub> = 29 dBm, 1 Mbps, 802.11b                           | -                                                          | -50  | -45  | dBm/MHz |
| 3f                                |                             |                                                                      | -                                                          | -50  | -45  | dBm/MHz |
| t <sub>dr</sub> , t <sub>df</sub> | Delay and rise/fall Time    | 50 % of V <sub>EN</sub> edge and 90/10 % of final output power level | -                                                          | 0.5  | -    | μs      |
| S <sub>11</sub>                   | Input Return Loss           | -                                                                    | 10                                                         | 15   | -    | dB      |
| STAB                              | Stability                   | CW, P <sub>OUT</sub> = 29 dBm<br>0.1 GHz – 20 GHz<br>Load VSWR = 4:1 | All non-harmonically related outputs less than -42 dBm/MHz |      |      |         |
| RU                                | Ruggedness                  | CW 50% duty cycle, PIN = +12dBm, Load VSWR = 6:1                     | No permanent damage.                                       |      |      |         |

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**Power Detector Characteristics**

Conditions:  $V_{CC} = 5\text{ V}$ ,  $EN = VENH$ ,  $T_A = 25\text{ }^{\circ}\text{C}$ , as measured on Skyworks Solutions' SE2576L-EV1 evaluation board, unless otherwise noted.

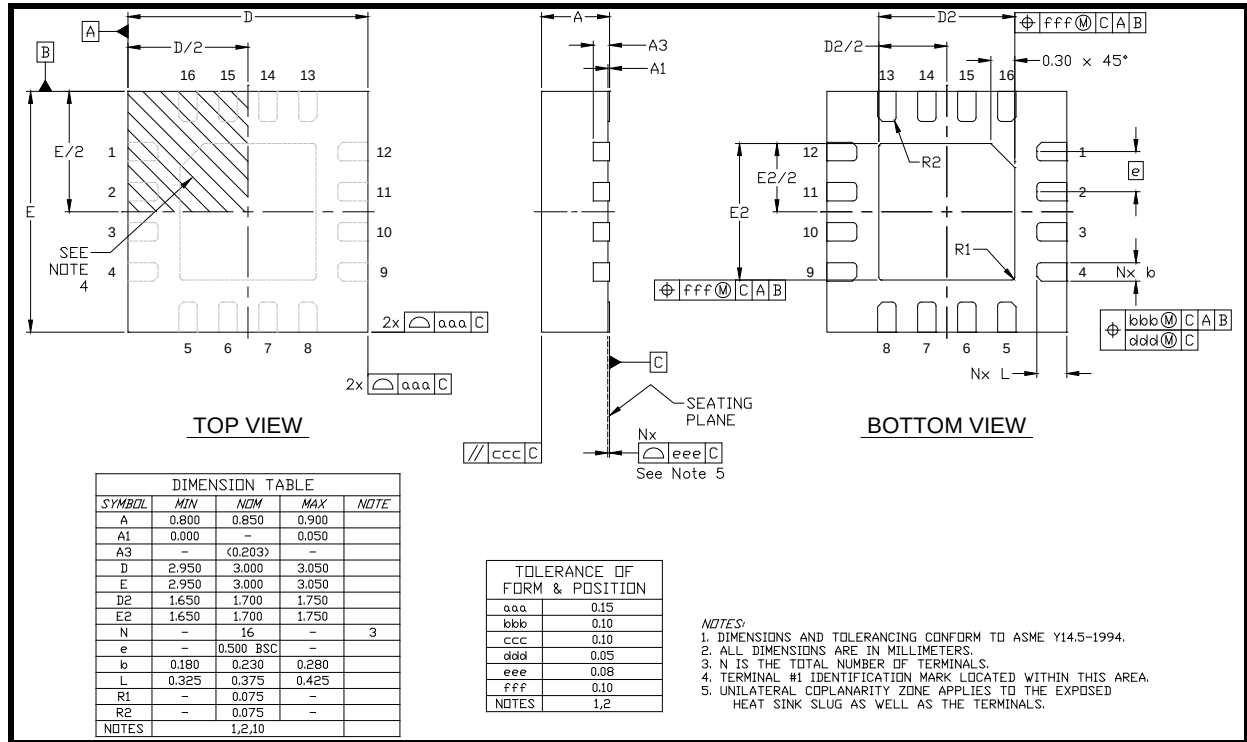
| Symbol       | Parameter                                          | Condition                    | Min. | Typ. | Max. | Unit      |
|--------------|----------------------------------------------------|------------------------------|------|------|------|-----------|
| $F_{OUT}$    | Frequency Range                                    | -                            | 2400 | -    | 2500 | MHz       |
| PDR          | Power detect range, CW                             | Measured at RF out           | 5    | -    | 30   | dBm       |
| $PDZ_{src}$  | DC source impedance on PD_OUT                      | -                            | -    | 2.3  | -    | $K\Omega$ |
| $PDZ_{LOAD}$ | DC load impedance                                  | -                            | -    | 26.5 | -    | $K\Omega$ |
| $PDV_{P5}$   | Output Voltage, $P_{OUT} = 5\text{ dBm CW}$        | Measured into 26.5K $\Omega$ | -    | 0.33 | -    | V         |
| $PDV_{P26}$  | Output Voltage, $P_{OUT} = 26\text{ dBm CW}$       | Measured into 26.5K $\Omega$ | -    | 0.70 | -    | V         |
| $PDV_{P30}$  | Output Voltage, $P_{OUT} = 30\text{ dBm CW}$       | Measured into 26.5K $\Omega$ | -    | 1.00 | -    | V         |
| $LPF_{-3dB}$ | Power detect low pass filter -3dB corner frequency | Measured into 26.5K $\Omega$ | -    | 2.0  | -    | MHz       |



**Figure 3: SE2576L Detector Characteristics**

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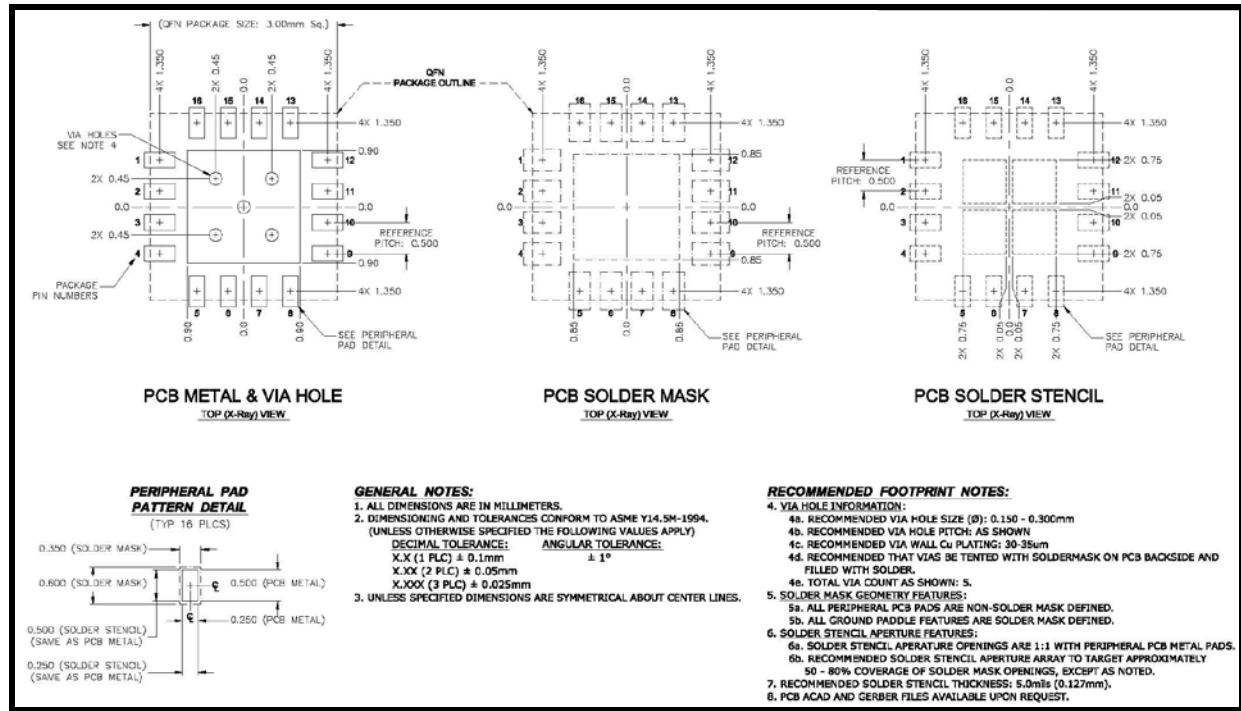
**Package Diagram**



**Figure 4: SE2576L Package Diagram**

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**Recommended Land and Solder Patterns**



**Figure 5: SE2576L Recommended Land and Solder Pattern**

**Package Handling Information**

Because of its sensitivity to moisture absorption, instructions on the shipping container label must be followed regarding exposure to moisture after the container seal is broken, otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly. The SE2576L is capable of withstanding a Pb free solder reflow. Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. If the part is manually attached, precaution should be taken to insure that the device is not subjected to temperatures above its rated peak temperature for an extended period of time. For details on both attachment techniques, precautions, and handling procedures recommended, please refer to:

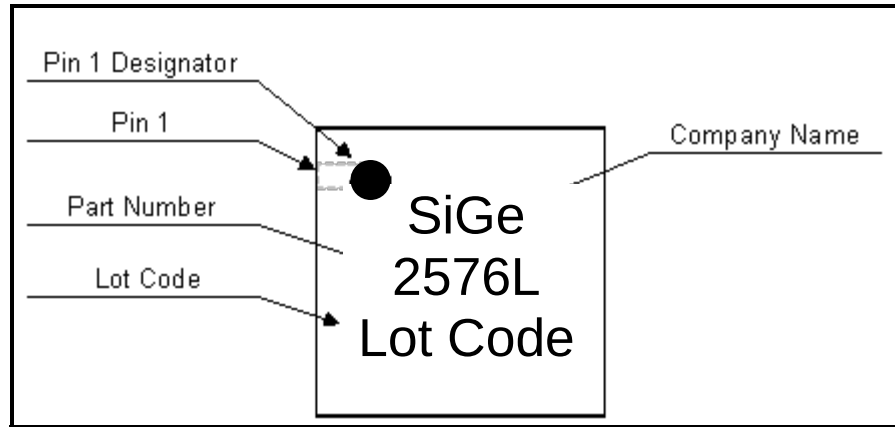
- "Quad Flat No-Lead Module Solder Reflow & Rework Information", *Document Number QAD-00045*
- "Handling, Packing, Shipping and Use of Moisture Sensitive QFN", *Document Number QAD-00044*



Caution! Class 1C ESD sensitive device

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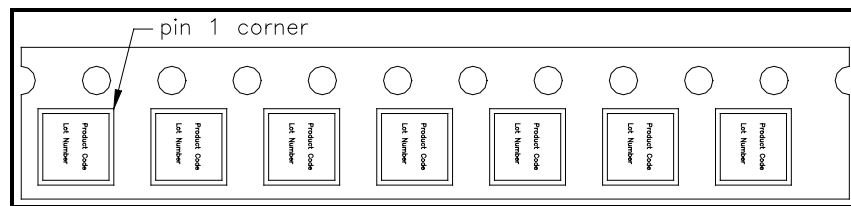
**Branding Information**



**Figure 6: SE2576L Branding**

**Tape and Reel Information**

| Parameter        | Value          |
|------------------|----------------|
| Devices Per Reel | 3000           |
| Reel Diameter    | 13 inches      |
| Tape Width       | 12 millimeters |



**Figure 7: SE2576L-R Tape and Reel Information**

**Document Change History**

| Revision | Date         | Notes                                                                          |
|----------|--------------|--------------------------------------------------------------------------------|
| 1.0      | Jan 10, 2009 | Created                                                                        |
| 1.1      | May 8, 2009  | Updated PA Control Logic Characteristics<br>Updated POD for SE2576L datasheet. |
| 1.2      | Jul 8, 2009  | Updated to correct pins 8 & 14 definitions.                                    |
| 1.3      | Aug 2, 2009  | Updated detector characteristics                                               |
| 1.4      | Sep 24, 2009 | Updated current consumption                                                    |
| 1.5      | Oct 25, 2009 | Updated detector plot                                                          |
| 1.6      | Jan 25, 2010 | Updated Off-State Leakage current                                              |





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| Revision | Date         | Notes                                               |
|----------|--------------|-----------------------------------------------------|
| 1.7      | Jun 22, 2010 | Extended operating temperature to Industrial limits |
| 1.8      | Dec 18, 2010 | Updated ESD rating<br>Added OFDM Mask Compliance    |
| 1.9      | Apr 10, 2012 | Updated with Skyworks logo and disclaimer statement |

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